NOAA Teacher at Sea Program

Lesson Plan by Teacher at Sea Virginia Warren
2013 Leg 3 Sea Scallop Survey aboard the R/V Hugh R. Sharp

Activity Title: Understanding and Maintaining Healthy Marine Ecosystems

Subject (Focus/Topic): These lessons address the importance of maintaining a healthy marine ecosystem.

Grade Level: 5th Grade

Average Learning Time: This group of lessons will take 4 to 5, one hour class periods to complete, as well as one day for a field trip.

Lesson Summary (Overview/Purpose): In this lesson students will research various marine ecosystems to gain understanding about how each organism in a marine ecosystem works together to have a healthy ocean. Students will also gain understanding of the importance of regulating marine fisheries to maintain a healthy food web within the ocean.

Overall Concept (Big Idea/Essential Question): These lessons are designed to help students understand how ecosystems work, the difference between a food chain and a food web, as well as the consequences to a food chain/web of overfishing.

Specific Concepts (Key Concepts):
- Each organism in an ecosystem is important.
- Maintaining a healthy food web is crucial to maintaining a healthy ecosystem.
- Regulating fisheries is important because it keeps the food web healthy.

Focus Questions (Specific Questions):
- What is an ecosystem?
- What is a food chain?
- What is a food web?
- How is energy exchanged in a food web or a food chain?
- What happens to the other organisms in a food web if one or more of the organisms is overfished?
- Why is it important to control the amounts of fish allowed to be caught every year?

Objectives/Learning Goals:
- Given a group of examples of marine organisms including producers, primary consumers, secondary consumers, and a tertiary consumers, students will be able to sort the organisms into a food chain and a food web with 80 percent accuracy.

- Given a fishery method, students will write an essay that explains the method and also why it is important to regulate fisheries with 80 percent accuracy.
- Given a test that has questions about ecosystems, food chains, and food webs, students will be able to complete the test with 80 percent accuracy.

Background Information:

- There are 12 main marine ecosystems: Abyssal Plain (communities include deep sea corals, whale fall, brine pool), Antarctic, Arctic, Coral Reef, Deep Sea (abyssal water column), Hydrothermal Vent, Kelp Forest, Mangrove, Open Ocean, Rocky Shore, Salt Marsh and Mudflat, Sandy Shore
- These ecosystems are the ones that each group of students will receive to research. **My information came from http://education.nationalgeographic.com/education/activity/mapping-marine-ecosystems/?ar_a=1

The following are notes that I have my students write into their science notebook throughout the unit.

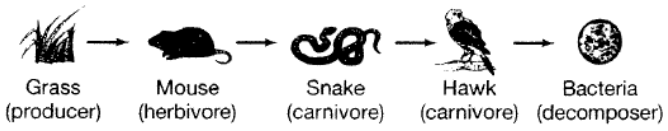
Ecosystems

A. Ecosystems
   1. ecosystem – made up of living and nonliving things that interact with one another in a certain place
   2. Two parts of ecosystems: biotic factors and abiotic factors
   3. biotic factors – the living parts of an ecosystem, includes plants, animals, bacteria, and fungi
   4. abiotic factors – the nonliving parts of the ecosystem, includes light, temperature, weather, soil, water, and air

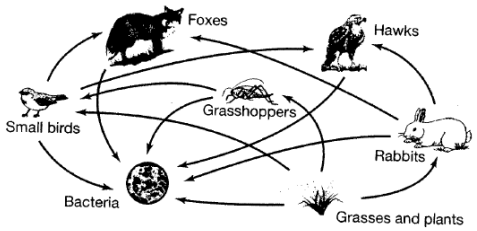
Food Chains and Food Webs

A. Background Vocabulary Terms
   1. producers – any organism that makes its own food, such as grass and algae
   2. consumers – an organism that gets energy by eating other organisms, such as humans
   3. decomposers – organisms that get energy by feeding on and breaking down dead organisms
      - Decomposers cause dead organisms decomposed or rot.
      - They are very important because they release nutrients from the dead organisms back into the soil.
   4. prey – any animal that is hunted or eaten for food
   5. predator – any animal that gets energy by preying (hunting/eating) other animals

B. Food Chain
   1. food chain – a series of living things that get food from one another
   2. A food chain shows the path of energy as it flows from one organisms to the next.



C. Food Web
   1. food web – a series of connected food chains
   2. Food chains and food webs are different because food chains only show one series, but animals don't just eat one thing, like in a food chain. A food web shows several ways organisms interact.



Relationships in Ecosystems

A. Community Relationships
   1. symbiosis – a relationship between two different organisms in which at least one of them benefits
   2. Types of symbiosis include mutualism, commensalism, and parasitism.
   3. Mutualism (+, +) – relationship in which both organisms benefit
      - Ex. Crocodile and a teeth cleaning bird
   4. Commensalism (+, Ø) – a relationship that helps one organism, but doesn't help or harm the other organism
      - Ex. Whales and barnacles, the barnacles benefit, but the whales do not.
   5. Parasitism (+, –) – a relationship where one organism must live in or on another organism to get energy, this usually causes harm to the host organism
      - Ex. Parasites get energy by feeding off another host organism. Such as fleas on a dog.

Common Misconceptions/Preconceptions:

- Students have a hard time understanding the arrow direction in a food web. I explain to my students by saying that whatever animal the arrow is pointing to is the animal that is doing the eating. For example using the picture above: the grass and plants are being eaten by the small birds, and then small birds are eaten by foxes.
- I show pictures of different examples of symbiotic relationships. Students and I decide if each organism in the relationship are experiencing positive (+), negative (-), or none (Ø), outcomes from the relationship.
- The large amount of vocabulary can be easily confused. I suggest making quick and easy vocabulary games that can be played quickly to help students remember the vocabulary terms. I also made small daily quizzes for students to take throughout the week so that I can gage daily understanding.

Materials:

Day 1 Materials:

- Teacher at Sea book, *Mr. Tanenbaum Explores Atlantic Fisheries on the NOAA Ship Henry B. Bigelow*
  **A PDF version of this book and other NOAA Teacher at Sea books/lessons can be found at this website: http://teacheratsea.noaa.gov/resources/

Day 2 Materials:

- Each group will need a copy of their ecosystem's **Marine Ecosystem Research Guide (attached below)**, which was adapted from the resources from the following website: http://education.nationalgeographic.com/education/activity/mapping-marine-ecosystems/?ar_a=1
- Internet access to complete research

Day 3 Materials:

- Students will need their completed Marine Ecosystem Research Guide
- SMART Board access to the following food web game: http://coolclassroom.org/cool_windows/home.html
- Poster board
- Colored pencils, markers, or crayons

Day 4 Materials:

- NOAA book, *A Good Catch – Managing Fisheries to Meet the Nations's Demand for Seafood* by NOAA Fisheries Service and Taylor Morrison
  ** A PDF copy of this book can be found at this website: http://www.education.noaa.gov/Marine_Life/A_Good_Catch_NMFS.pdf
- Fisheries Chart (attached below) to complete on the Smart Board
- Students will need their completed Marine Ecosystem Research Guide
- Plain white printer paper
- Colored pencils, markers, or crayons
- Scallops and stingrays printed on cardstock paper for the students to cut out and paint
- Earth colored paints to paint the scallops and stingrays
- Paint brushes

Technical Requirements: SMART Board, student computers to complete research

Teacher Preparation:

- The teacher will need to have a working understanding of how ecosystems, food chains, and food webs work.
- The teacher will also need to prepare the notes of information they want students to place in their notebooks.
- The teacher will need to make a copy of the **Marine Ecosystems Research Guide** printed for each group's ecosystem then and give each group a computer to use to complete the research guide.
- The teacher will also need the Fisheries Chart on the SMART Board to complete as a group for the beginning of Day 4's lesson.

- If the teacher wishes to create the display from Day 4's lesson, they will need to have copies of scallops and stingrays on cardstock for the students to paint. The teacher will also have to paint the shark for the display.
- The teacher will need to make a grading rubric to assess each group's food chain, food web, and essay.
- The teacher will need to create a test that or copy the one below that addresses the information from these lessons.
- If the teacher plans to take their students on a field trip to an aquarium, they will need to prepare a scavenger hunt, as well make necessary preparations for the field trip.

Keywords:
- Ecosystems
- Food Webs
- Food Chains
- Producer
- Consumer
- Tertiary Consumer
- Fisheries

Pre-assessment Strategy/Anticipatory Set (Optional): At the beginning of each lesson the teacher will either read a passage from a book, show pictures, or play an online game to get the students' attention.

Lesson Procedure:
Day 1:
- The teacher will put the Teacher at Sea book, *Mr. Tanenbaum Explores Atlantic Fisheries on the NOAA Ship Henry B. Bigelow* on the SMART Board to read with the students about how scientists study marine life. This will be used as an introduction to the new ecosystems unit we will start.
- Students will write notes in their science notebook about ecosystems, food chains, and food webs.
- Important vocabulary: ecosystem, producer, consumer, herbivore, carnivore, omnivore, decomposer, food chain, food web, primary consumer, secondary consumer, and tertiary consumer
- Students will draw a basic example of a food chain and a food web in their notes.

***Students will be put into groups and assigned a marine ecosystem to complete the following lessons.

Day 2:
- Show several pictures of different organisms found in marine ecosystems to get the students attention.
- Each group will be assigned a marine ecosystem to research. Groups will use the **Marine Ecosystem Research Guide** to complete as they are researching their marine ecosystem.
- The **Marine Ecosystem Research Guide** has the students search for a real world example of their ecosystem, organisms and physical features found in their ecosystem.

- Students will also have to try and find at least 3 real-world examples of producers, primary consumers, secondary consumers, tertiary consumers, and decomposers found in their ecosystem. (Students may find that it is harder to find 3 tertiary consumers.)
- At the end of the lesson, groups will label their ecosystem on a blank world map on the Smart Board, so that, as a class, we can discuss the different types of organisms found in each ecosystem and where each ecosystem is on our planet.

**Parts of day 2's lesson were inspired by a National Geographic online lesson intended for grades 9-12. http://education.nationalgeographic.com/education/activity/mapping-marine-ecosystems/?ar_a=1

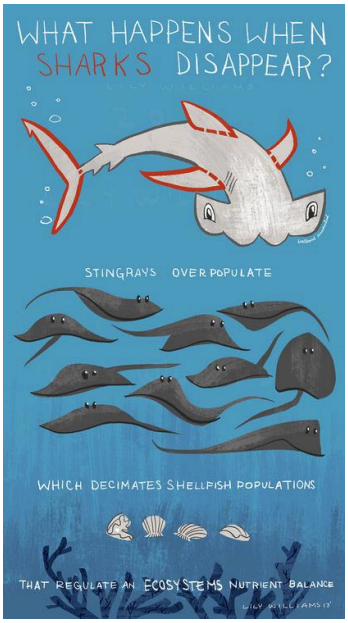
Day 3:

- Students will get back in to their group from the previous day. They will also be given their **Marine Ecosystem Research Guide** to complete the activities.
- Students will use the organisms from their research to create a food chain. Students will label each of the organism as either a producer, primary consumer, secondary consumer, or tertiary consumer.
- If a group finishes early, then they can make another version of a food chain using the organism from the **Marine Ecosystem Research Guide**.
- Students will correctly place the marine organisms in their correct spot on the food web game from this website: http://coolclassroom.org/cool_windows/home.html
- Students will take all 3 examples of the producers, primary consumers, secondary consumers, tertiary consumers, and/or decomposers to create a food web on a poster board.
- Each food web should be labeled to identify which marine ecosystem it represents.
- Each level of the food web should be labeled as either producers, primary consumers, secondary consumers, tertiary consumers, or decomposers.

Day 4:

- Read parts of *A Good Catch – Managing Fisheries to Meet the Nations's Demand for Seafood* by NOAA Fisheries Service and Taylor Morrison. Use the book to teach the students about the different types of fishing methods used to harvest marine organisms.
- While reading, students will complete the **Fisheries Chart** on the SMART Board to describe positives and negatives about fishing methods.
- After reading, students will pick a food chain from the previous day to discuss what will happen to the other organisms in the food chain if one of those organisms was overfished.
- The discussion continues on to a food web made on the previous day. Students will discuss what will happen if more than one organism in the food web is overfished.
- Today's lesson is intended to not only continue teaching about food chains and food webs, but also to teach about the importance of managing a healthy fishery.
- Students will get back into their group to draw an example of the fishing method they think would be the most useful for their assigned ecosystem. Students will also write a 1-2 paragraph essay that explains the fishing method they chose for their ecosystem and also why it is important to manage a fishery in their ecosystem.

- As students are working in their groups, they will be called to paint either a sea scallop or a sting ray. The paintings will be used to create a NOAA Teacher at Sea display for the school office.
- This display will include pictures and information from my Teacher at Sea time aboard the R/V Hugh R. Sharp. However it will mainly feature the students' paintings of organisms in a healthy food chain. The display will also include each groups' example of their marine food web, fishing method, and essay that explains the importance of maintaining a healthy ecosystem.
- The picture by Lily Williams below is where the idea came from to make a food chain display.



** For more information visit the NOAA's Fisheries Website at http://www.nmfs.noaa.gov/ or go to the educators' part of NOAA's Fisheries Website at http://www.nmfs.noaa.gov/stories/2012/10/noaa_fisheries_education.html

Day 5 (optional)

- Students will go on a field trip to a local aquarium and zoo. (I am taking my students to the New Orleans Audubon Aquarium and Zoo.)
- Students will be given an aquarium scavenger hunt where they will identify organism found in different ecosystems.

Assessment and Evaluation: The assessment and evaluation of these lessons will take place throughout the lessons. Each group will be evaluated with a rubric on the completion of their **Marine Ecosystem Research Guide**, their example of a marine food chain, their poster of a marine food web, the fishery method example, and their essay that explains the importance of maintaining a healthy ecosystem. At the end of the lessons, students will also take a test on ecosystems, food chains, and food webs.

Group Member Names: _____

Standards:

- **National Science Education Standard(s) Addressed:**
  - NSES Content Standard C- Life Science: Populations and Ecosystems

- **Ocean Literacy Principles Addressed:**
  - Ocean Literacy Principle 5: The ocean supports a great diversity of life and ecosystems.
  - Ocean Literacy Principle 6: The ocean and humans are inextricably interconnected.

- **State Science Standard(s) Addressed:**
  - Alabama Science State Standard 9: Describe the relationship of populations within a habitat to various communities and ecosystems.

- **Next Generation Science Standards:**
  - Next Generation Science Standard 5-LS2-1: Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

Additional Resources:

- NOAA's Fisheries Website at http://www.nmfs.noaa.gov/ or go to the
- Educators' Part of NOAA's Fisheries Website at http://www.nmfs.noaa.gov/stories/2012/10/noaa_fisheries_education.html
- Google Earth: Ocean http://www.google.com/earth/explore/showcase/ocean.html#

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Resources from these lessons follow:

Types of Fisheries	Pros	Cons

Marine Ecosystems Research Guide

Name of the Ecosystem	
Locations of One or More Real-World Examples of the Ecosystem	
Marine Organisms Found in the Ecosystem	Two or Three Producers: _____, _____, _____ Three or Four 1st Level Consumers: _____, _____, _____, _____ Two 2nd Level Consumers: _____, _____ One or Two Tertiary Consumers: _____, _____ One or Two Decomposers or Scavenger: _____, _____ One or Two Omnivores: _____, _____
Physical Features of the Ecosystem and Unique Characteristics	
Extra Important Information	

On the back of this paper:

- Sketch your example of a food chain from your ecosystem. It must have one producer, one 1st level consumer, 1 2nd level consumer, 1 tertiary consumer, and 1 decomposer or scavenger.

- Sketch your example of a food web from your ecosystem. It must include all of the organisms listed in the "**Marine Organisms Found in the Ecosystem**" section of the Research Guide chart above.

Parts of this lesson were adapted for lower grades from the following website:
http://education.nationalgeographic.com/education/activity/mapping-marine-ecosystems/?ar_a=1

Sportfishing		
Commercial Fishing: Long Line		
Commercial Fishing: Gill Net		
Commercial Fishing: Pots		
Commercial Fishing: Trawler		
Commercial Fishing: Purse Seiner		